A SKETCH

OF THE

HISTORY, ORIGIN AND DEVELOPMENT

OF THE

SOUTH CAROLINA PHOSPHATES

COMPILED BY

A. R. GUERARD, A. R. S. M.

MINERALOGIST FOR THE NEW ORLEANS EXPOSITION FOR THE DEPARTMENT OF AGRICULTURE,

COLUMBIA, S. C.

CHARLESTON, S. C.

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THE HISTORY OF THE DISCOVERY.

South Carolina, sometimes known as Charleston phosphate, was discovered in the latter part of 1867, at a place called "Lambs," about twelve miles above Charleston, on the Ashley River. The marls of Carolina appear to have been known and identified by geologists as far back as 1797. In 1832 attention was drawn by Mr. Ruffin, of Virginia, to the fact that these marls were valuable as a fertilizer; and in 1848 Tuomey, in his Geological Report of South Carolina, speaks of irregular and water-worn fragments of marl stones, found in the Ashley River marl-beds, and claims for these a value far above the Virginia marls, because they contained from 1 to 10 per cent. of phosphate of lime. In 1850 Prof. Holmes, of Charleston, read a paper before the "American Association for the Advancement of Science," in which he described nodules of marl rock, referring to them as "siliceous" masses. So-called "rocks" or "stones," found lying on the surface of the land, or turned up in ploughing, were well known to old planters on the coast. But it is evident that, though these rocks or nodules were long an object of scientific investigation and local curiosity, the true nature and chemical composition of the Carolina phosphates were as yet unknown and unsuspected. It was not until 1867 that the late Dr. St. Julien Ravenel, of Charleston, upon receiving some specimens of these nodules, recognized their value, and pointed out their agricultural importance. The deposit *in situ* was discovered by Prof. F. S. Holmes, who, with Dr. Ravenel and Dr. Pratt, of Atlanta, shares the credit of a discovery which has proved and must continue to be a source of wealth to South Carolina, and a benefit to agriculture, both in this country and in Europe, the importance of which cannot be estimated. It may seem strange that the value of this deposit should not have been recognized before, when it was lying here, seen, but neglected, under the very eyes of geologists and chemists some time after the agricultural use of phosphate of lime was known to the world. But South Carolina, before the war, being in a state of agricultural prosperity, there was, doubtless, less importance attached to this matter

than would otherwise have been the case; and as usual it was the necessity of effort, the demand for a means of livelihood, which led to the great discovery. By that wonderful provision of nature, which so often awes and impresses us, the aid was given, the supply was furnished, when the demand was greatest.

The first company organized to excavate the phosphates was the Charleston Mining and Manufacturing Company, which was formed with Northern capital, furnished by Messrs. Geo. D. Lewis and Frederick Klett. The first shipment of this company was sixteen tierces by steamer *Falcon*, consigned to Geo. D. Lewis, Philadelphia, Penn. The manufacture of commercial fertilizers, under the chemical superintendence of Dr. St. J. Ravenel, had begun in Charleston shortly before this, using the Navassa phosphate as a source of phosphoric acid. Henceforth native phosphate was substituted for the Navassa phosphate, and, under Dr. Ravenal's direction, new fertilizer works were put up to utilize the phosphate which was now being mined at home.

OCCURRENCE AND CHARACTER OF THE PHOSPHATE DEPOSIT.

The phosphate deposit occurs in beds or strata of rough masses or nodules, of a size varying from a part of an inch to several feet in diameter, and is associated with numerous fossil bones and teeth. It is found on the bottoms of the shallow creeks and rivers which intersect the coast, and on the low lands which form a belt of country running parallel to and from ten to fifty miles from the seaboard. The beds are from 6 to 20 odd inches in thickness, and the limit of a workable deposit is 8 feet under ground, or 20 feet under water. The phosphatic nodules are known as land or river rock, according to the element in which they are found. The average yield of the land deposit is 600 to 800 tons per acre, and though sometimes occurring in "pockets," that is, irregularly, these deposits are remarkably uniform, many contiguous acres often containing a phosphate-bearing stratum at an accessible depth. The river rock, having been washed into the rivers from the land, has occasionally accumulated in thicker beds than the original deposit of land rock. The river rock is obtained by dredging, chiefly in the Bull, Stono and Coosaw Rivers; the land rock is dug mainly in the section of country lying between the Ashley and Stono Rivers, and Rantowle's Creek. Extensive strata of excellent quality are also known on the banks of the Edisto, and between the Edisto and Ashepoo Rivers, but this deposit has not yet been worked to any extent. About and below Beaufort occur a number of very heavy beds of river rock, but generally of lower grade.

The land rock is lighter in color than that found under water or marsh mud, the former having a yellowish or pale brown color, the latter a dark gray or bluish black. The river

rock is considerably harder than that occurring in the land deposit, but either variety may be readily ground to a powder so fine that it floats in the air (so-called floats). Carolina phosphate gives out, when rubbed, a peculiar fetid odor, the denser it is, the more conspicuous the odor, due to the presence of organic matter. It is very porous, some of it being capable of absorbing 15 or 20 per cent. of water. The surface of the nodules is frequently indented with holes and cavities naturally filled with clay and sand, which require to be carefully washed out; when the washing is imperfectly performed the phosphate is of lower quality. Carolina phosphate is remarkably uniform in composition, containing, on an average, from 55 to 61 per cent. tricalcic phosphate, and from 5 to 11 per cent of carbonate of lime. Among its other constituents are silica, oxide of iron, fluorine, sulphuric acid, traces of alumina and magnesia, water and organic matter.

ORIGIN OF THE PHOSPHATIC DEPOSIT.

The question of the origin of the phosphate of lime in this deposit has, as yet, received too little study to afford a satisfactory theory. But it awakens such general, as well as scientific interest, in the minds of all who have seen or heard of the deposit, that it may not be amiss to state, briefly, the several hypotheses which have been advanced. One of these assumes that the fragments of marl were charged with the sweepings from guano beds formed above them by the congregation there, at some past period, of vast flocks of birds; in this case bones of the birds should be among the fossils preserved in the deposit, but no such remains have been found. Another theory supposes that as the remains of numerous extinct animals, such as the mastodon, elephant, megatherium, tapir, deer, horse, etc., occur associated with the beds, immense herds of these animals must have collected at one time about shallow salt licks or lagoons, formed during a partial submergence of the coast, in which the nodules of marl were left upon the recession of the sea, and that the phosphoric acid derived from their bones and excrements brought about the change in the marl. It is objected to this theory that the places where the most bones, etc., are found are not the richest in phosphate, and while it is by no means probable that the nodules were in all, or even in most instances formed where they are at present found, it is difficult to suppose that agencies of such local and restricted character as salt licks could account for the conversion of so great a mass of material, over an area so extensive as that presented by the phosphate formation; that a similar deposit found at a depth of seventy feet in the artesion well borings in Charleston could not be explained in this way. The most plausible theory advanced as an explanation of the formation of these nodules is that certain marine organisms, or mollusks, possess the power of secreting phos-

phoric acid from sea-water, and that through them the marl, and especially the upper strata, became charged with a certain amount of phosphate of lime. That the proportion of the phosphate of lime thus obtained to the whole body of the superficial layers of the marl was afterwards increased; first, by the removal of a considerable amount of carbonate of lime, rendered soluble by the percolation through it of rain water containing carbonic acid, derived from the decomposition of vegetable matter in the soil overlaying the marl; second, by a well known proneness of phosphoric acid, when diffusely distributed, to concentrate and to give rise to concretionary processes similar to those observed in the flint nodules and pebbles of the English chalk, and in other formations. This theory agrees with the diffused occurrence of phosphate of lime in the superficial layers of the marl, as well as with the fact that the upper layers of the deposits and the outside of the nodules are the richest in phosphate. It substitutes for a local cause a general one, commensurate at once with the wide area occupied by the phosphate rock, and by the phosphatic marls of the South Atlantic sea board. Such a cause also might have been in operation ages ago, when the layers of phosphate rock found in the artesian well borings were forming; and it may be in operation now, as the dredging work of the United States Coast Survey shows that the marls accumulating at the depth of 200 fathoms on the floor of the Gulf Stream, between Florida and Cuba, contain a considerable percentage of phosphate of lime. (see Hand Book of State of South Carolina, and Emmons' report to Pacific Guano Company, 1876).

THE WORKING OF THE LAND DEPOSIT.

Having carefully examined the land for phosphate, its depth, thickness of statum, etc., a field is selected and drained by means of trenches, technically known as "line pits," dug around the tract and reaching below the level of the rock bed. This field is about 600 yards wide, and made as long as possible for transportation of the rock dug A tram-road for horse, or steam, is constructed through the midst of the field in its length, and then, commencing at the "line pits" and working in towards the tram, pits measuring 6 by 12 feet, are sunk in long paralled lines. The superincumbent earth is thrown up with shovels behind the men, and the phosphate rock dug out with picks and cast on the untouched ground in front When trees are in the field they are undermined and thrown over on the side which has already been excavated. The rock is rolled from the pits in barrows and dumped on platforms on the roadside, whence it is loaded into cars for transportation to the washers. The labor on the phosphate fields is performed almost altogether by negroes, sometimes convict labor being employed. Italians have occasionally been imported as labor-

ers, but they have not been found to do the work required as well as the blacks, who alone can stand the hot suns and malaria of the phosphate swamps in summer. The hands are not generally paid by the day, but by the foot dug, the price being in most mines twenty-five cents a foot for a pit of 6 by 12 feet, the rolling of the rock inclusive. At this wages they make about a dollar a day on the average, sometimes more and sometimes less, according to the character of the land, and depth of rock from the surface. Land miners have not considered it profitable to work deposits at a greater depth than eight feet beneath the surface.

The clay, sand, &c adhering to the rock, which amounts to one-half or two-thirds of the whole mass, are removed by washing. The crude rock as it comes from the pit is carried to the washers, large heavy pieces of machinery worked by steam, and situated near some creek or river where there is an ample supply of water. The rock is here passed first through roller crushers armed with steel teeth, which break up the larger nodules to a uniform size of not more than four inches in diameter. These then fall into long wooden troughs or tubs resting on a slight incline through which resolve wooden shafts furnished with iron teeth fixed in the form of a spiral screw. The nodules being forced by the screw up the incline against a strong stream of water are rubbed one on the other until, cleansed of all clay etc., they are thrown out at the open end of the tub After being screened they are then transported to the dry-sheds, or dumped outside the washer building.

The land deposits are owned by companies or individuals, or are leased upon a royalty for a term of years.

THE WORKING OF THE RIVER DEPOSIT.

The river deposit is now worked principally by dredging; but some years ago before the shallower creeks were exhausted of rock, large quantities of phosphate were raised by "Handpicking," "Tongsing" and "Diving." "Handpicking" was resorted to in such deposits as run dry at low water, and consisted in loosening the nodules by means of the pick and crow-bar, and throwing them into flat boats to be carried to the shore. "Tongsing" was the term applied to raising such deposits as were too deep to be handpicked, but which were within reach of the oyster tongs. Diving was occasionally practiced by the negroes in summer in water from 6 to 10 feet deep, to bring up large loose nodules, which were too heavy to lift with the tongs. These apparently primitive methods of working answered admirably as long as the deposits were shallow and labor cheap; but it was not long before the more powerful appliances of steam and machinery came into use.

A very large portion of the Carolina phosphate, and by far the largest portion of the river deposits, are now raised by dredging from deep waters, where the nodules lie on the bot-

tom sometimes covered by a layer of sand and mud several feet in thickness. The dredges heretofore employed have been found to work best in not more than twelve feet water, twenty feet being the limit. At this depth they are able to tear up the thickest and hardest phosphate beds; and under favorable circumstances as much as 100 tons of rock a day have been raised to the dredge. The dredge, which is the ordinary single machine, empties the mass of nodules, marl, sand, mud, shells, etc., on a floating washer of simpler though similar construction to that employed for washing land rock. The clean rock is loaded into "lighters" or barges, and transported to dry-sheds on shore.

Several efforts have recently been made with specially adapted machines to raise the deposit lying at greater depths, and in larger quantity than the ordinary dredge can do, but so far none of these attempts have been successful. At the present time there are two immense dredging machines in progress of construction which are calculated to do more and better work than has yet been done, but these machines are not at work, and no opinion, therefore, can be formed of them. There is no doubt, however, that the more inaccessible deposits will be excavated whenever the demand for phosphate is sufficient to necessitate the supply, and though that day may not yet have arrived, it is not so far distant.

One of the most important operations in the preparation of phosphate rock for market is the drying of it, though it is one which has been much neglected by phosphate miners. The river rock has long been dried for foreign shipment in order to lessen the cost of freight, and to raise the per centage of phosphate of lime in the rock. But land rock, which has been chiefly consumed at home, is seldom dried even now to less than six or seven per cent. of water, and contains often as much as ten per cent., the local Fertilizer works purchasing the rock wet and drying it as needed

The most satisfactory method of drying employed so far is the hot-air process, sun drying being too slow and uncertain to be efficacious, and other methods tried having proved too expensive on the large scale. A hot blast of air is forced by a fan through perforated iron pipes into a brick kiln or dry-shed; into these sheds which hold 500 tons and over, the wet rock is dumped upon the pipes, over which are sometimes laid logs of wood to aid in distributing the heat through the mass. In this way 500 tons can be dried in thirty-six hours to from one to three per cent. of moisture. This process would seem to entail a great waste of heat and fuel, but it answers sufficiently well in practice, and as long as wood is cheap is more economical than any other.

The river miners work under charters from the State, which grant them a general right to work a specified territory with any other comers, or under an exclusive right to such territo-

ry. In either case they pay a royalty to the State of $1.00 for every ton of rock raised.

NUMBER AND NAMES OF COMPANIES MINING PHOSPHATE ROCK.

The following list gives the names of the Companies at present engaged in mining land and river rock:

Land Mining Companies.

(1.) Charleston Mining and Manufacturing Co. (Works on Ashley River, near Charleston.)
(2.) Gregg's Phosphate Mines. (Works on Ashley River, near Charleston.)
(3.) Pinckney's Phosphate Mines. (Works on Ashley River, near Charleston.)
(4.) Rose Phosphate Mining and Manufacturing Co. (Works on Ashley River, near Charleston.)
(5.) Pacific Guano Co. (Works on Bull River.)
(6.) St. Andrew's Phosphate Mining Co. (Works on Stono River.)
(7.) Wando Phosphate Mines. (Works on Ashley River, near Charleston.)
(8.) Bradley's Phosphate Mines. (Works on Rantowles' Creek, near Charleston.)
(9.) Drayton & Co.'s Phosphate Mines. (Works on Ashley River, near Charleston.)
(10.) Bolton Phosphate Mines, (Works on Stono River, near Charleston.)
(11.) Chisolm Phosphate Mines. (Works on Ashley River, near Charleston.)
(12.) Fishburne Phosphate Mines. (Works on Ashley River, near Charleston.)
(13.) Pon-pon Phosphate Mines (Works on Edisto River.)
(14.) Dotterer's Phosphate Mines. (Works on Church Creek, near Charleston.)

River Mining Companies.

(1.) Coosaw Mining Co. (Works on Coosaw River, near Beaufort.)
(2.) Oak Point Mines Co. (Works on Wimbee Creek, near Beaufort.)
(3.) Sea Island Chemical Co. (Works on Beaufort River.)
(4,) Farmer's Phosphate Co. (Works on Coosaw River.)
(5.) Hume Bros. & Co. (Works on Beaufort River.)

In addition to these the following individuals are mining on a smaller scale on general rights:

(6.) David Roberts. (On Wimbee Creek.)
(7.) J. W. Seabrook. (On Morgan River.)
(8.) J. M. Crofut. (On Beaufort River.)
(9.) J. DeB. & J. Seabrook. (On Parrot Creek.)
(10.) Willis Wilkinson. (On Stono River.)
(11.) J. G. Taylor. (On Parrot Creek.)

The Land Mining Companies engaged employ a capital of $1,980,000; 1,286 hands, with $363,560 wages. Their products amount to $1,283,830.

The River Mining Companies engaged employ a capital of $525,000; 649 hands, with $259,300 wages. Their products amount to $907,170.

The total capital employed is $2,505 000; number of hands, 1,935; wages, $622.860; products, $2,190,000.

(See Hand Book of State.)

Mined and Shipped.

The following table gives the total amount of phosphate rock mined and shipped since the discovery of the South Carolina deposits:

	Tons.		Tons.
1868–70	20,000	1878	210 000
1871	50,000	1879	200,000
1872	60,000	1880	190,000
1873	90,000	1881	265,000
1874	100,000	1882	330,000
1875	115,000	1883	355,000
1876	135,000	1884	409,000
1877	165,000		
Total			2,699,000

Of this amount:

	Tons.
River Rock	1,229,170
Land Rock	1,469,830
Total	2,699,000

This amount at the very moderate average of six dollars per ton has given to the State $16,149,000, of which the State has been benefited by a royalty of $1,229,170.

The cost of production per ton varies. It is estimated at $4.50, including the payment of royalty and other expenses. Upwards of one hundred thousand tons of crude rock are annually consumed by the fertilizer manufactories of South Carolina.

The value of the phosphate now annually mined is $2,500,000. The royalty paid to the State in 1884 was $153 797,62, being one dollar per ton paid as moved by the marine companies. The taxes levied on the product of the land companies, and the heavy tax on the fertilizer manufacturers are exclusive of this large amount of revenue.

See Annual Report of *News and Courier*, and View of the (Industrial Life of the State.)

THE EXTENT OF THE PHOSPHATE DEPOSIT.

No systematic survey, determining the extent of these deposits, has yet been attempted. The only information on this head comes from prospectors, seeking easily accessible rock in localities convenient for shipment. Widely varying estimates as to the quantity of the rock have been ventured. Some have placed it as high as five hundred millions of tons, and others as low as five millions. The latter is the estimate of Dr. C. U. Shepard, Jr., who has prepared a map of the region. He traced the deposit over 240,000 acres, and estimates the *accessible* rock as covering only about 10,000 acres. Even this estimated area at 800 tons per acre, which he gives as an average, should yield 8,000,000 tons. But if we examine a single mining region, as that for instance occupied by the Coosaw Company, we must conclude that he has very greatly underestimated the amount. This Company has the exclusive right to a territory of about 6,000 acres in Coosaw River, besides the adjacent marshes yet unexplored. Everywhere the river bottom is covered with rock, which for the most part forms a solid sheet, varying from eight inches to one and one-half feet in thickness. Taking the lesser thickness, we have, with a specific gravity of 2.5, after subtracting twenty-five per cent. for loss in washing or drying, something more than 1,700 tons to the acre, which would give for the river territory alone belonging to this one Company something more than ten millions of tons. And in effect this Company (which is the only thoroughly equipped river mining company now at work, 1881,) consider in spite of their large plant * * * * * * that their supply of material is practically unlimited. (Hand Book of the State.)

COMPETITION FROM OTHER QUARTERS.

But it may be asked, is our little State the sole possessor of these phosphate beds; or have we to fear competition from other quarters? The deposits of phosphate rock have been found at various points along the South Atlantic Coast, reaching from North Carolina to Florida, and also in Alabama. But these deposits have not yet been sufficiently developed to compete with the South Carolina phosphate, and will probably not come into the market until our deposits are nearly exhausted. There are numerous phosphate deposits in Europe, among which may be mentioned the Spanish Phosphorite, the Canadian Apatite, the Bordeaux and Nassau phosphates, the English and French Coprolites, the Belgian phosphates, the Navassa phosphate, and the Guanoes of the Islands of the Pacific Ocean; but none of these phosphates, though some are much richer than ours, can at present compete with us in accessibility, cheapness and uniform quality. Occasionally there are rumors of vast deposits being discovered in Russia, in the Pacific

Islands, etc.; but so far the South Carolina phosphate forms the back bone, so to speak, of the phosphate industry not only of America, but of England. And it should be remembered, moreover, that even should we meet with competition abroad and thus lose the foreign trade in phosphate, which is now very large, our home trade is ever on the increase, and that it is to the Western and Southwestern States of the Union that we should look for our future field of consumption In this field, at any rate, we need hardly fear competition as long as these deposits can supply the demand.

THE MANUFACTURE OF COMMERCIAL FERTILIZERS.

The gigantic manufacture of artificial manures is based on the treatment of phosphate of lime with sulphuric acid, by which the phosphate of calcium is decomposed, sulphate of calcium formed, and the phosphoric acid converted into a soluble acid calcium salt (a superphosphate), or else reduced to the free state. The suggestion to act on bones with sulphuric acid was made by Liebig (1840); the utilization of Crystalline and Fossil phosphates by a similar treatment was the work of Lawes (1843).

The process of manufacturing superphosphate of lime ordinarily employed, which is the one carried out at the Fertilizer Works near Charleston, is briefly as follows: The kiln dried phosphate rock is ground to powder in mills such are used for grinding flour, and then treated with sulphuric acid in the proportion of 900 pounds of Chamber acid of 49 degrees Beaumé to 1,000 pounds of phosphate. This is performed by machinery in so-called "mixing tubs" or "manure mixers," the product being a superphosphate containing ten to twelve per cent. soluble phosphoric acid. From the mixer the manure, which is still liquid, is run into store-houses where it is allowed to set. It becomes so hard after a time that it has to be cut down with a pick, and the lumps passed through a disintegrator to reduce them to powder, which is then filled into bags and is ready for shipment. Certain gases are given off during the mixing; these are carbonic acid, fluoride of silicon, hydrochloric acid and water. Most of these are extremely irritating to the lungs, and injurious to health and vegetation, their perfect removal is a vital necessity, and flues for this purpose are placed above the mixer.

In making most phosphate manures a mixture of ingredients is employed. Either it is desired to produce a manure containing a certain definite percentage of soluble phosphate, or to introduce nitrogen and potash into the manure. To attain the first object, a higher and lower quality of phosphate are mixed together before treating it with acid: for the second object the acid super-phosphate is mixed afterwards with ammoniacal matter—dried blood, fish scrap, etc., and German potash salts (kainit, or muriate of potash). The manures re-

sulting from such mixtures are known as "acid phosphate," "dissolved bone," "ammoniated acid phosphate," "complete fertilizer," "ash element," etc.

All the more important fertilizer works near Charleston manufacture their own sulphuric acid; this indeed constitutes one of their most expensive operations. For this purpose sulphur is imported from Sicily, only one of the works near Beaufort using iron pyrites from Spain.

Superphosphate of lime supplies to the soil large quantities of phosphoric acid, sulphuric acid, and lime, and, in the case of a mixed manure, also nitrogen and potash. In analyses of super-phosphates the phosphoric acid is estimated in three forms, as soluble in water, soluble in citrate of ammonia, and insoluble. The soluble phosphate (by which is meant phosphate soluble in water) consists of monocalcium phosphate with some free phosphoric acid. When applied to the land the soluble phosphate is dissolved by rain, and distributed more or less throughout the surrounding soil. When thus brought in contact with fertile soil, the soluble phosphate is more or less speedily precipitated. This precipitation is brought about either by the carbonate of lime in the soil, or by the hydrated oxide of iron and alumina present. In the first case a more or less insoluble phosphate of lime, and in the second a basic phosphate of iron and alumina are formed. As basic phosphates of iron and alumina are certainly forms of phosphoric acid which can only be slowly appropriated by plants, it is evident that the main effect of soluble phosphate must be yielded within a short time of its application. The insoluble phosphate of the superphosphate was formerly supposed to consist simply of the orignal phosphate of the material which had escaped the action of the acid; we now know that the insoluble phosphates consist partly, and in some superphosphates largely, of "reduced" or "reverted" phosphates, that is phosphates which have *gone back* to the insoluable condition owing to the action of the lime, iron, and alumina. There has lately been much discussion in the agricultural and chemical world as to the manurial value of these reduced and insoluble phosphates as compared with the phosphates soluble in water. It has been argued by some that the manurial value of reduced phosphate must be equal to that of soluble phosphate, because soluble phosphate becomes itself reduced after contact with the soil; and hence they have consented to call at least a part of these reduced phosphates "available" in the soil. Others have gone farther, and maintain that the non-crystalline insoluble phosphate, such as the Carolina phosphates, when ground to an impalpable powder, and composted with vegetable matter producing carbonic acid upon decomposition, or used along with certain leguminous plants as a fallow crop, are equally efficacious as reduced, or even super-phosphate. They hold that the use of sulphuric acid

in the manufacture of super-phosphate is not only unnecessary and expensive, but absolutely injurious. The late Dr. St. J. Ravenel, of Charleston, was of this opinion, in which he is confirmed by the views of several distinguished chemists in England, Scotland, France, and Germany, and by practical results in the field, both at home and abroad.

NUMBER OF COMPANIES ENGAGED IN MANUFACTURING FERTILIZERS IN SOUTH CAROLINA.

There are at present engaged in manufacturing commercial fertilizers in South Caroliua:

(1). The Atlantic Phosphate Company—capital $200,000; works located on Ashley River, near Charleston.

(2). The Stono Phosphate Company—capital $135,000; works located on Ashley River, near Charleston.

(3). The Etiwan Phosphate Company—capital $300,000; works located on Cooper River, near Charleston.

(4). The Pacific Guano Company—capital $1,000,000; works located on Ashley River, near Charleston.

(5). The Wando Phosphate Company—capital $100,000; works located on Ashley River, near Charleston.

(6). The Ashepoo Phosphate Company—capital $50,000; works located on Ashley River, near Charleston.

(7). The Edisto Phosphate Company—capital $200,000 works located on Cooper River, near Charleston.

(8). The Ashley Phosphate Company—capital $100,000 works located on Central wharf, Charleston.

(9). The Wilcox & Gibbs Guano Company; works located on Cooper River, Charleston.

(10). The Hume Bros. Phosphate Company—capital $500,000; works located on Beaufort River, near Beaufort.

(11). The Port Royal Fertilizing Company—capital $125,000 works located on Battery Creek, near Port Royal.

MANUFACTURED FERTILIZERS SHIPPED.

The following table gives the total amount of fertilizers shipped since 1871:

	1871. Tons.	1872. Tons.	1873. Tons.	1874. Tons.
Charleston	20,487	37,183	56,298	46,302
Savannah	27,447	32,922	56,296	30,895
Port Royal	.....	.....	.....	.....
Total	47,934	70,105	112,594	77,197
	1875.	1876.	1877.	1878.
Charleston	49,500	47,381	45,766	52,000
Savannah	33,187	33,000	45,591	61,500
Port Royal	4,000	12,000	26,000	15,000
Total	86,687	92,381	117,357	128,500
	1879.	1880.	1881.	1882.
Charleston	55,000	80.000	100,000	95,000
Savannah	60,000	65,000	110,000	100,000
Port Royal	12,000	26,000	39,245	28,279
Total	127,000	181,000	249,245	223,279
		1883.		1884.
Charleston		130,000		143,790
Savannah		125,000		70,000
Port Royal		25,000		23,094
Total		280,000		236,884

NOTE.—Of the shipments from Port Royal, 11,022 tons were fertilizers manufactured at the works in Beaufort.—[See Annual Report of *News and Courier*.]

CONSUMPTION OF FERTILIZERS.

In a compilation by Mr. De Ghequier, Secretary of the Chemical and Fertilizer Exchange of Baltimore, we find:

Total consumption of commercial fertilizers in	Tons.
Southern States	460,000
Delaware, Eastern States	25,000
Pennsylvania, New York, New Jersey	90.000
New England States	40,000
Western States	20,000
Total	635,000

According to this statement, it would appear that the South Carolina companies are able to produce at least one-third of the whole amount of fertilizers consumed in the United States.

CONCLUSION.

In this sketch, which has necessarily been brief and imperfect, attention has been drawn only to the most remarkable facts in the history, origin and development of the South Carolina phosphates. Statistics up to date have been given, showing that the phosphate industry has steadily increased in importance every year since the discovery of the deposits, until to-day it constitutes the largest and most successful enterprise in the State. The benefit that has been conferred, not only upon the planters of the State and the Southern country in general, but also upon the whole agricultural world, by the development of these phosphates, cannot now be computed. For ourselves, it is impossible to realize what we would have done without them, and we dread to think of the day when they will have become exhausted. I venture to say, however, that this last we need not fear at least for years, even generations to come. And by the time that South Carolina has exhausted her supply, let us hope that the deposits in some of our sister States will have been sufficiently developed not only to furnish us with phosphates as bountifully as we have done them, but have enough to spare for the rest of the world.